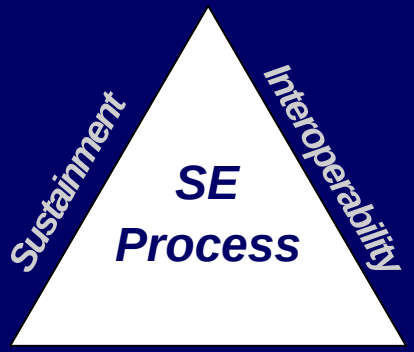
Certified
Naval Battle Groups



Managing Family of Systems Capabilities, Converging Integration

NDIA Systems Engineering Conference
October 21-24 2002

Sharon Linsenmeyer
Director, Warfare Systems Engineering

Paul T. Smith
Director, Standards Policy and Guidelines

Steve Burke
Battleforce Command & Control Lead

Transformational Concepts

Sea Strike

- *Project decisive and persistent offensive power anywhere in the world*
- *Launch immediate, agile and sustainable operations from the sea*

Sea Shield

- *Assure access throughout the battlespace for the Joint Force*
- *Project defense around friends, allies, and coalition and the Joint Forces*
- *Provide a sea-based layer of homeland defense*

Sea Basing

- *Project forces worldwide with capability to fight & win*
- *Operate immediately from an expanded and secure maneuver area – the sea*
- *Minimize vulnerabilities tied to overseas land support*

FORCEnet

Align & integrate warriors, networks, sensors and weapons to implement Network Centric Warfare

The Fog of Acquisition

- Defense Acquisition is a High Stakes Business "Battlefield"
- Multidimensional "Influences" Outnumber Integrated "Controls"
- Perfect "Battlefield" Intelligence is Not Achievable
- Inadequate Training, Resources And Incentives to Address the "Bigger Picture"
- Business Opportunities Multiply In This Chaos

Can We Converge On the Right Warfighting Capabilities?

Solutions are Complex

- We can Manage n… Dimensions, Mitigate the Fog and Deliver the Right Warfighting Product
  - Capability Based Process and Architectures
  - An Enabled Engineering Environment
  - Disciplined Architecture and Engineering Underpinning
  - Process Integration
  - Capability Master Plan
  - Corporate Engagement

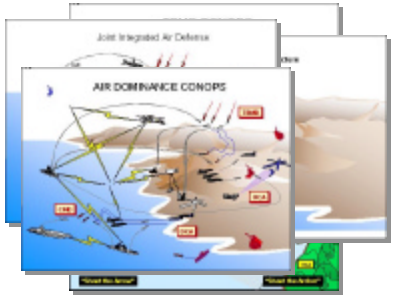
Capability Based Process and Architecture

- Architecture Basis (DoD Architecture Framework)
- Systems Engineering Based on Architectures
- Family of System/System of Systems (FoS/SoS) Capability Focus
- Defined Capability Evolution (Capability Evolution Description (CED)
- Defined Baseline Metrics and Performance Attributes

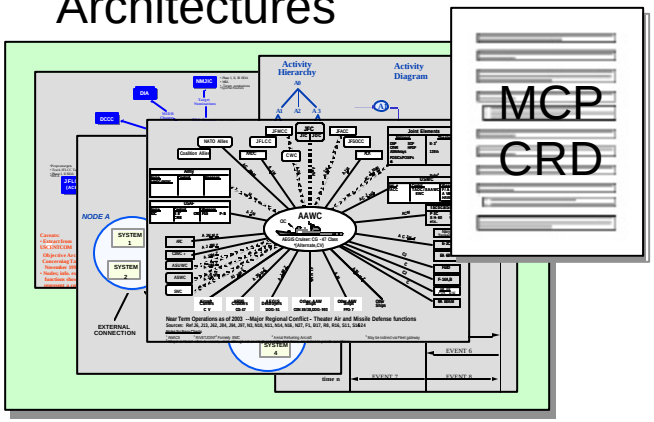
Battle Force Capability Assessment and Programming Process (BCAPP)

MCP Requirements Integration

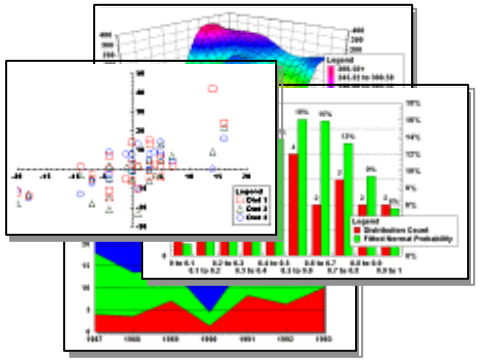
Concepts & CONOPS



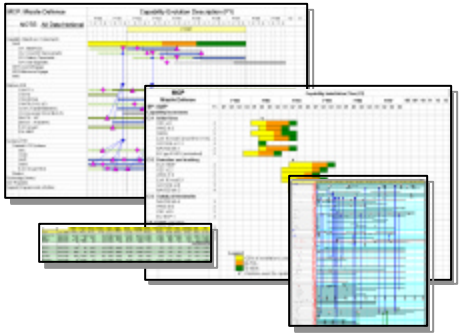
Operational Architectures + CRDs



System-of-Systems AOAs

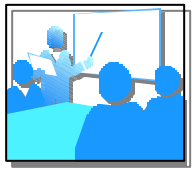


Integrated Strategic Capabilities Plan (ISCP)



CED

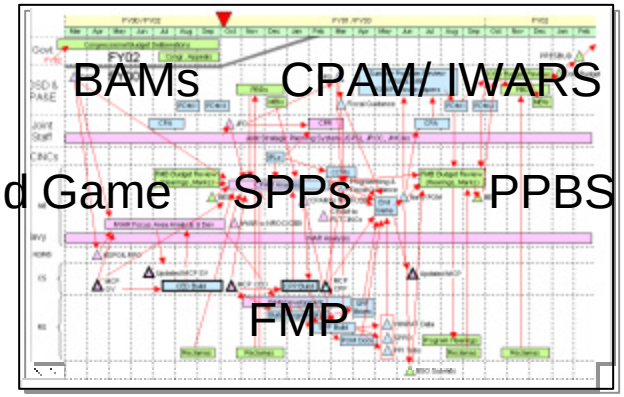
NROC / CEB



BAMs CPAM/ IWARS

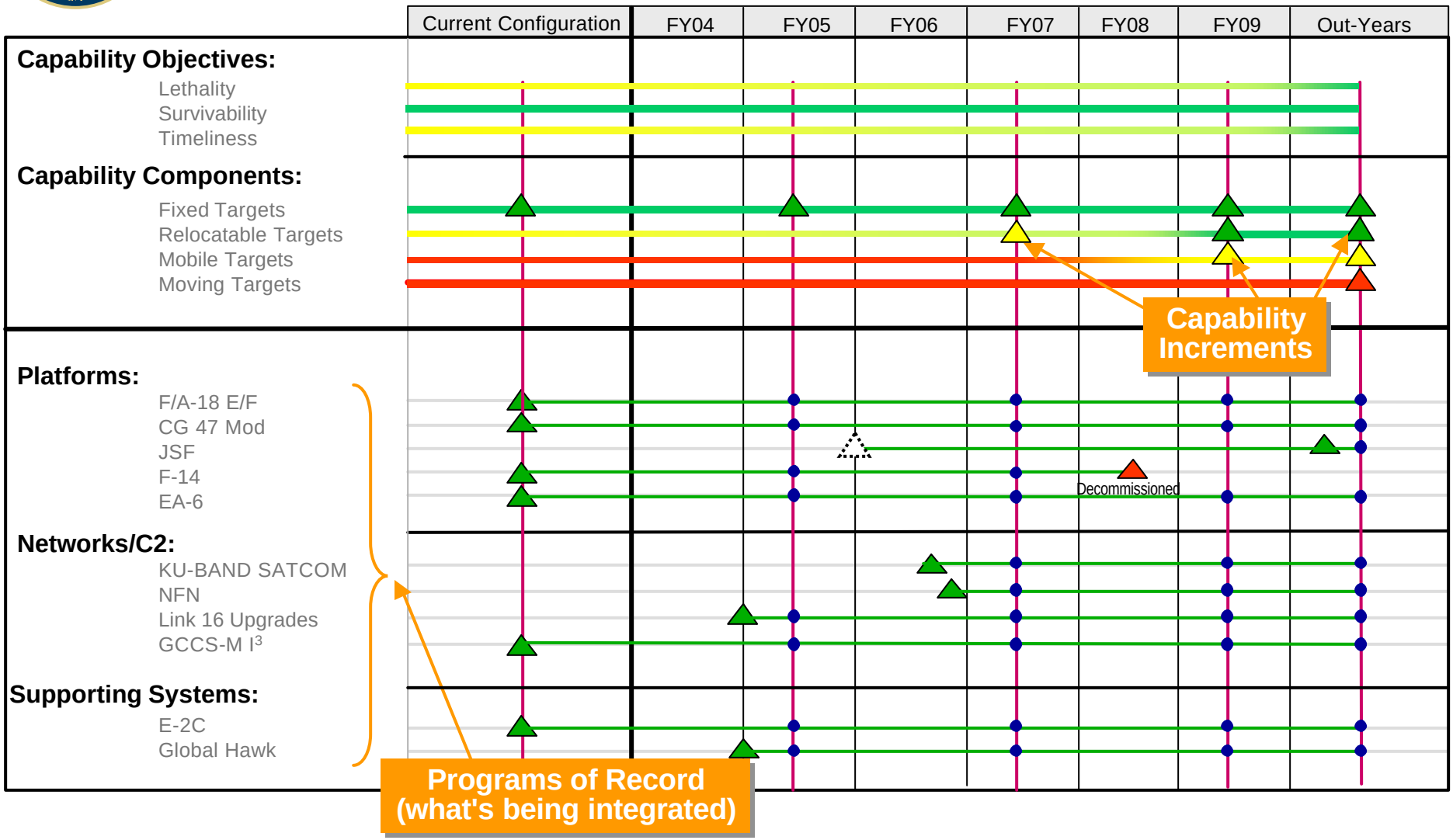
End Game SPPs PPBS

FMP



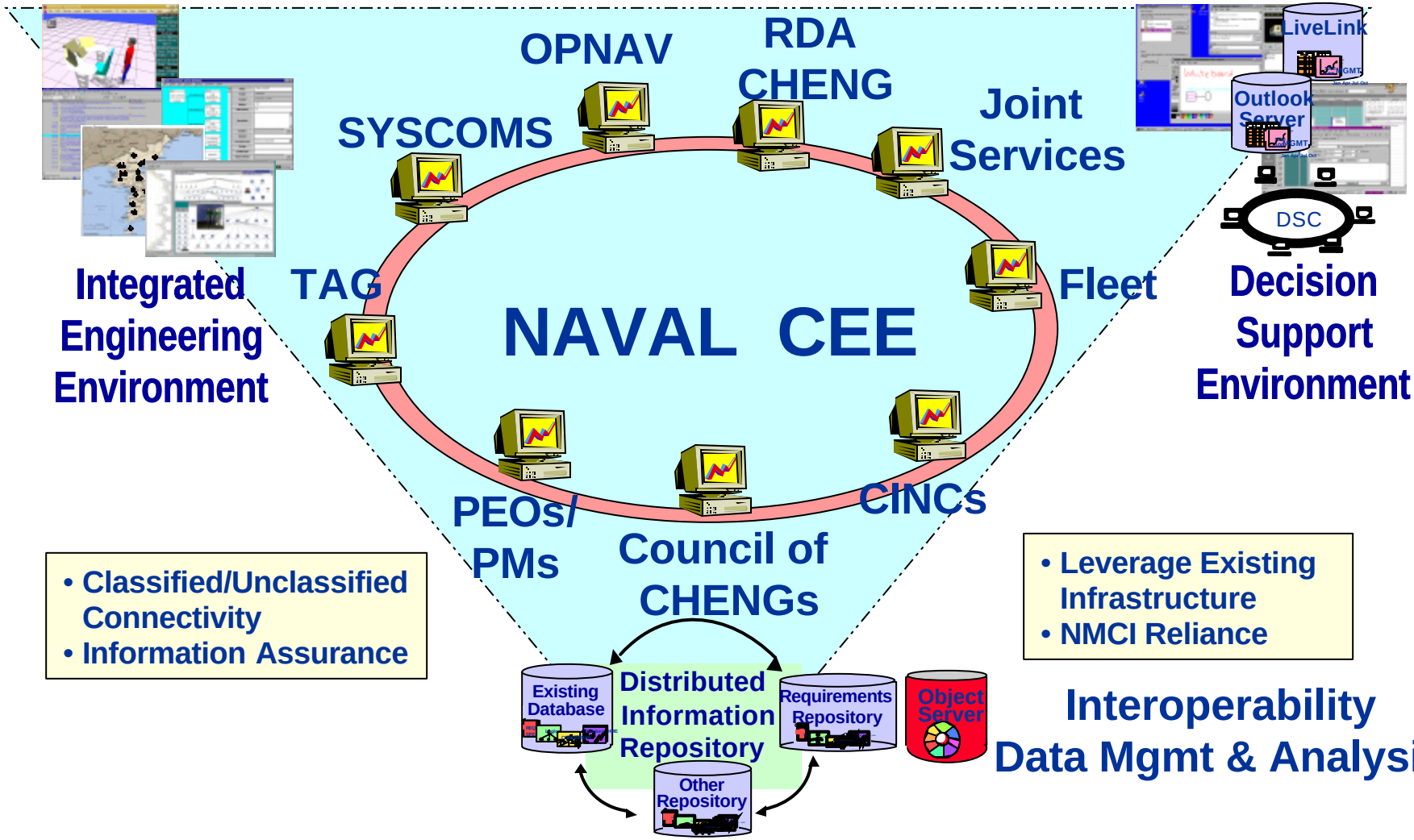
SPD

Notional Strike CED Sample



Flag Level CED Will Hide Sensors and Weapons Under Platforms

An Enabling Naval Collaborative Engineering Environment



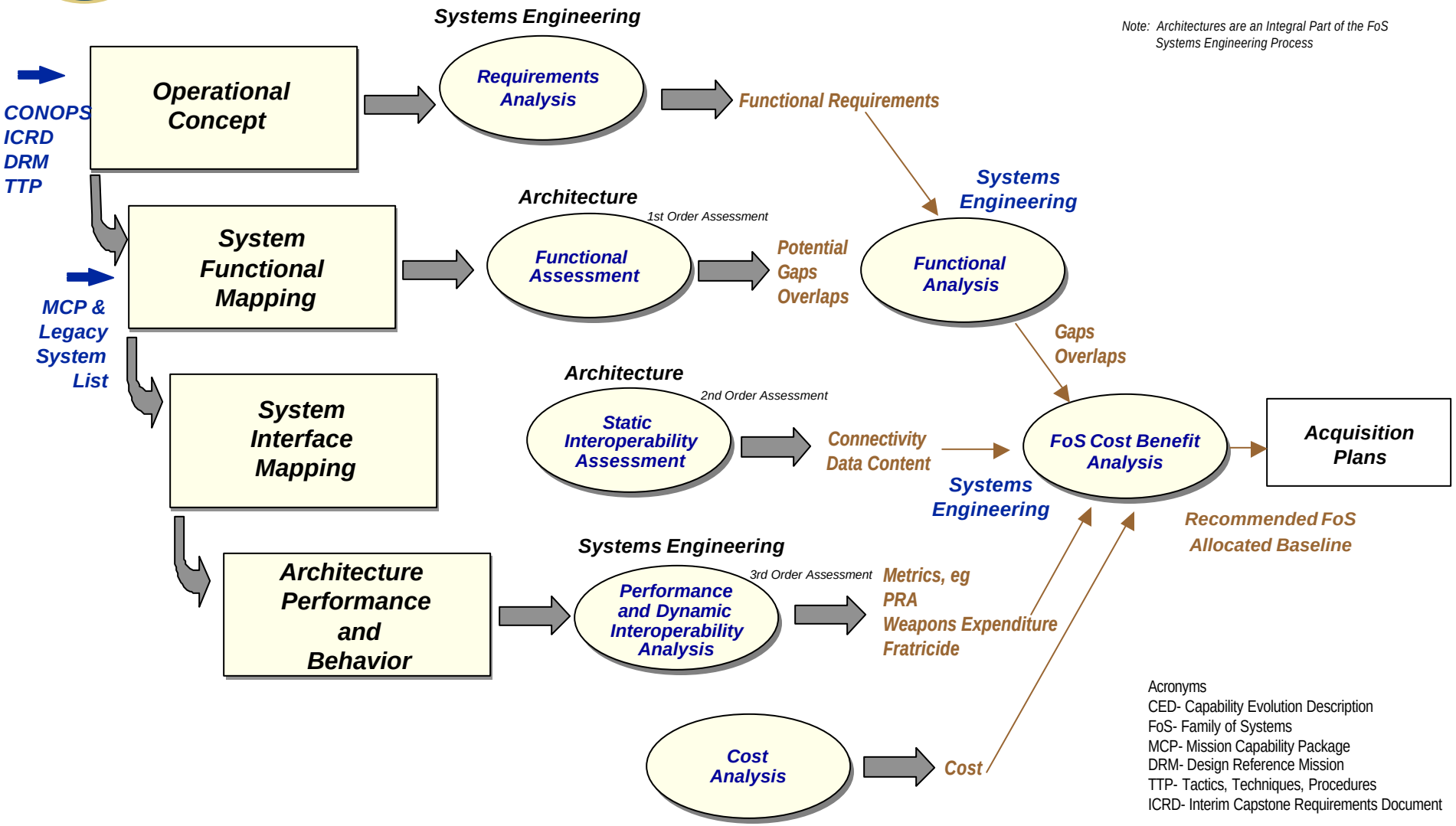
- Classified/Unclassified Connectivity
- Information Assurance

- Leverage Existing Infrastructure
- NMCI Reliance

Interoperability
Data Mgmt & Analysis

Classified and Unclassified Connectivity to Enable Stakeholder Collaboration

Architecture Based Systems Engineering
The Technical Underpinning



Acronyms
CED- Capability Evolution Description
FoS- Family of Systems
MCP- Mission Capability Package
DRM- Design Reference Mission
TTP- Tactics, Techniques, Procedures
ICRD- Interim Capstone Requirements Document

Acquisition Plans Derived Through Architecture Assessments and Systems Engineering Trades

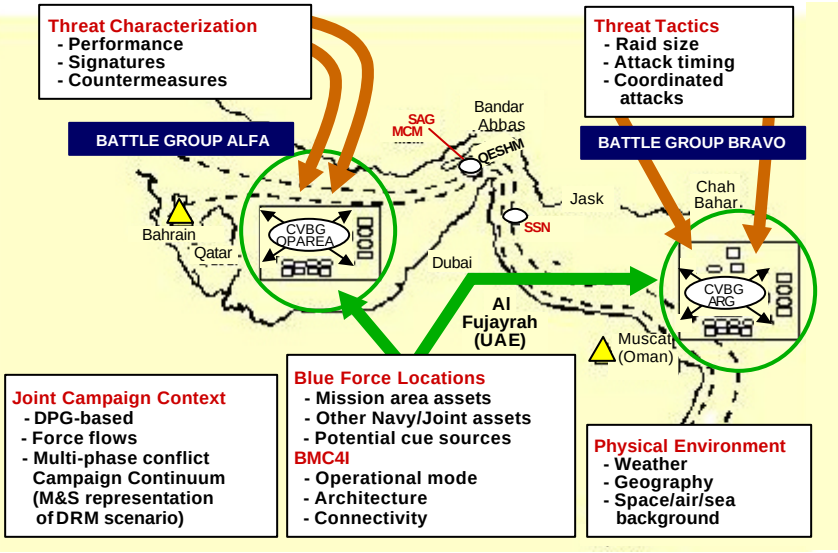
Systems Engineering at The Capability Level

- Disciplined Architecture Based Systems Engineering
  - Systems Engineering IPT
  - Systems Performance Document (SPD)
  - Integration and Interoperability Risk Assessment
  - Independent Design Review
- Defined Baseline Performance Metrics
  - Design Reference Mission
  - Key Performance Parameters
  - System → Platform → Family of Systems → Capability
  - Battleforce Certification

BF Design Reference Mission

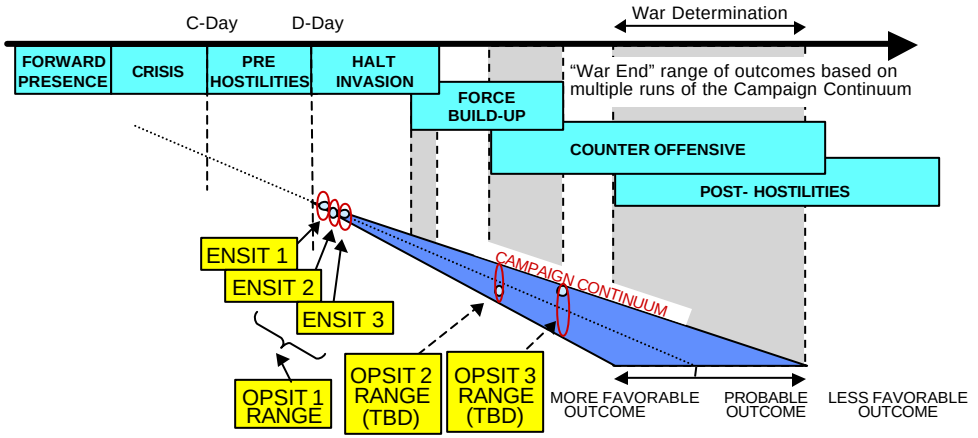
BATTLE FORCE DESIGN REFERENCE MISSION (DRM)

Provides a <u>common</u> authoritative description of representative operational environments to support the development of combat systems and platforms.



The Campaign Continuum

- Provides Dynamic Campaign Modeling of a DPG Scenario.
- Provides a Continuous Multi-warfare Flow of Situations Throughout the Campaign.
- Develops the Range of Critical Initial Conditions for Systems Engineering Analysis.



Enables Capability Performance Analysis at the Battleforce Level

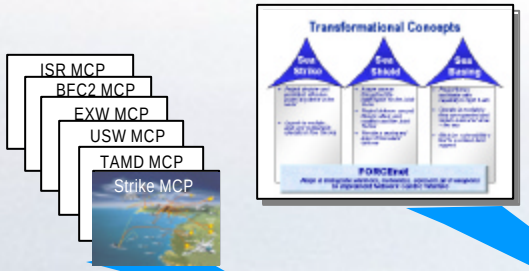
Example Baseline Performance Metrics

Measure of Performance (MoP)	*15-50 nm*	*50-100 nm*	*100+ nm*
Dual Tracks *Number of tracks per target of interest*	1.2 or less	1.4 or less	1.7 or less
ID Differences *System driven conflict-alerts per target of interest in a given time period*	10 alerts / hour or fewer	15 alerts / hour or fewer	20 alerts / hour or fewer
Track Correctness *System track location versus actual geographic location per target of interest.*	2.5 nm or smaller difference	4 nm or small difference	6 nm or smaller difference
ID Correctness *Correct ID (Ground Truth) versus System ID (within system capabilities) per target of interest*	80% or greater correct ID	70% or greater correct ID	60% or greater correct ID
Track File Consistency *Average of unit-to-unit comparisons of tracks held throughout Force on a given track*	70% or greater consistency	60% or greater consistency	50% or greater consistency
Track Number Stability *Number of track number changes in 1 hour per target of interest*	2 or less changes per hour	4 or less changes per hour	6 or less changes per hour

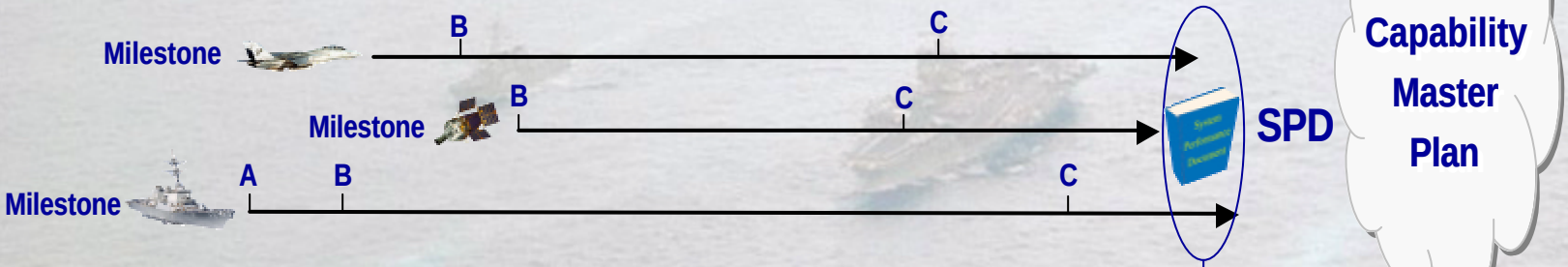
- **Metrics Must:**
  - **Quantify Capability Performance**
  - **Measure Incremental Capability Improvements**
  - **Quantify New Warfighting Capabilities**
  - **Be Measurable Across the Acquisition Life Cycle**

Converging Integration of Processes

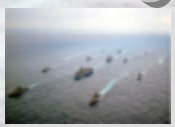
Requirements and Resourcing: OPNAV



Acquisition: ASN (RDA), PEOs/PMs



Battleforce Certification and Deployment: Fleet /SEA 53



CED- Capability Evolution Description
MCP- Mission Capability Package
SPD- Systems Performance Document
ISCP - Integrated Strategic Capability Proposal
ISPP- Integrated Sponsor Program Proposal

Alignment is Needed Between Resourcing, Acquisition, and Deployment

Capability Master Plan
Converging Integration of Products

- Systems Performance Document Defines Integrated Requirements and Capabilities With Metrics
- Capability Evolution Description Defines Time Phased Increments of Mission Capability
- Integrated Strategic Capability Plan
- Integrated Sponsor Program Proposal provides Programmatic Roadmap Alignment
- Promotes Program and Fiscal Stability
- Tool to Enable Risk Management in the nth Dimension

Vision (ISCP) + ISPP + CED(s) + SPD(s) + Emp Sked(s) = Master Plan

Corporate Engagement

- Organize to Manage and Assess at the Capability Level
- Ensure Subject Matter Experts are Fully Engaged
- Establish Necessary Business Rules
- Manage Necessary Business Compromise (ROI vs Risk at the Operational Capability level)
- Train and Educate

Create a Culture Energized for Transformation

Navigating The Fog

- Establish and Implement Capability Based Architecture and Systems Engineering Processes (Integrated)
- Utilize Common tools and engineering source data – Naval Collaborative Engineering Environment (NCEE)
- Align, Resource and Execute the Master Plan to Deliver War Fighting Capabilities

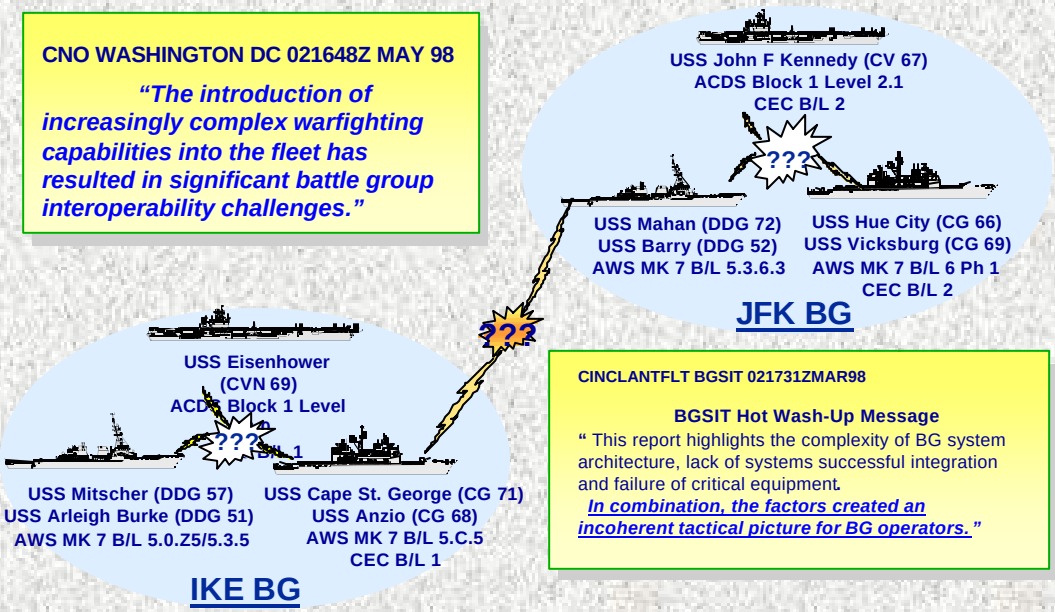
Backup

Inadequate Integration & Interoperability Exacts a Price

Navy Battle Group Operations: 1997 - 1998

CNO WASHINGTON DC 021648Z MAY 98

"The introduction of increasingly complex warfighting capabilities into the fleet has resulted in significant battle group interoperability challenges."



CINCLANTFLT BGSIT 021731ZMAR98

BGSIT Hot Wash-Up Message

" This report highlights the complexity of BG system architecture, lack of systems successful integration and failure of critical equipment.

In combination, the factors created an incoherent tactical picture for BG operators."

Resolutions of System Deficiencies:

- ***Caused Nearly 10% Program Growth***
- ***Perturbated Program Execution Budget and Timelines***
- ***Disrupted CINC Deployment Plans***

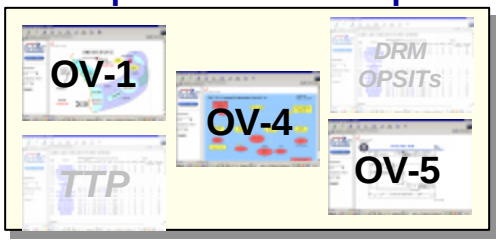
What's Needed? . . . *Elevating Systems Engineering to a New Level*

Using Architecture Products in Systems Engineering & Acquisition

Rev 5 (1)

NAVSEA
NAVAL SEA SYSTEMS COMMAND

Operational Concept



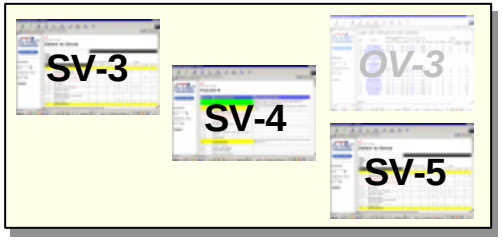
Functional Architecture

The Role of Engineering and Technology

Physical Architecture

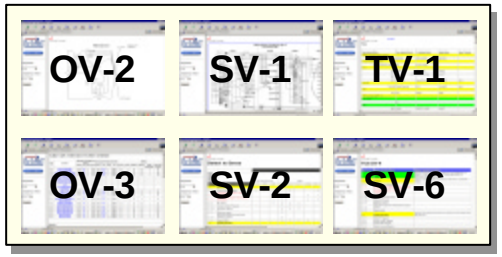
CV-6	Capabilities Evolution Description
OV-1	High-level Operational Concept Graphic
OV-2	Operational Node Connectivity Description
OV-3	Operational Information Exchange Matrix
OV-4	Command Relationships Chart
OV-5	Activity Model
OV-6C	Operational Event/Trace Description
SV-1	System Interface Description
SV-2	Systems Communication Description
SV-3	Systems Matrix
SV-4	System Functionality Description
SV-5	Operational Activity to System Function Traceability Matrix
SV-6	System Information Exchange Matrix
SV-7	System Performance Parameters Matrix
SV-8	System Evolution Description
SV-9	System Technology Forecast
SV-10	System Activity Sequence & Timing
TV-1	Technical Architecture Profile
TV-2	Standards Technology Forecast

System Functional Mapping



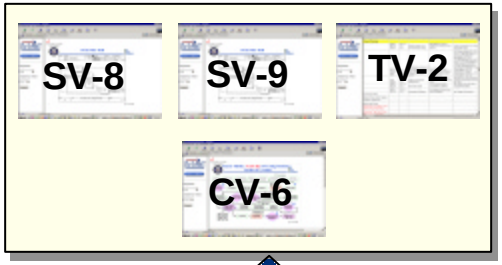
1st Order Assessment:
Functionality

System Interface Mapping



2nd Order Assessment:
Static Interoperability

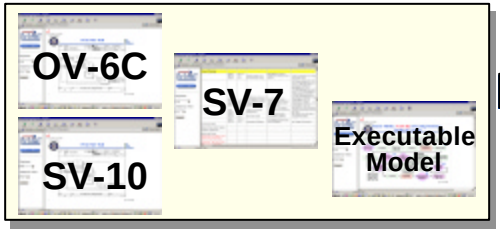
Acquisition Plans



DRM: Design Reference Mission
OPSIT: Operational Situation
TTP: Tactics, Techniques, Procedures

Note: There are dependencies between the Architecture products that are not shown in the System Engineering flow. Many of the products are developed concurrently.

Architecture Performance and Behavior



3rd Order Assessment:
Dynamic Interoperability

Architectures Provide the Framework and Assessment for FoS/SoS Systems Engineering

CHENG I & I Overview

Notional Acquisition Cycle

Mission capability definition, resourcing and Acquisition oversight

Integrate, certify and deploy operational mission capabilities

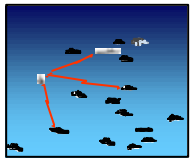
New Systems and Legacy Upgrades

Milestone A

- *Preliminary Architecture Views*
- *Initial JTA Assessment*
- *FoS integration document*
- *I&I risk assessment*

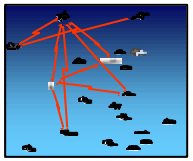
Milestone B

- *Integrated Architecture*
- *JTA assessment*
- *FoS integration document*
- *I&I risk assessment*
- *C4ISP compliance*
- *T&E Planning assessment*



Milestone C

- *D-30 SoS certification*
- *Integrated Architecture*
- *JTA Assessment*
- *System Performance Analysis*
- *I&I risk assessment*
- *OT&E Certification*



Requirements Resourcing | **Acquisition** | **Certification** | **Deployment**

IOC

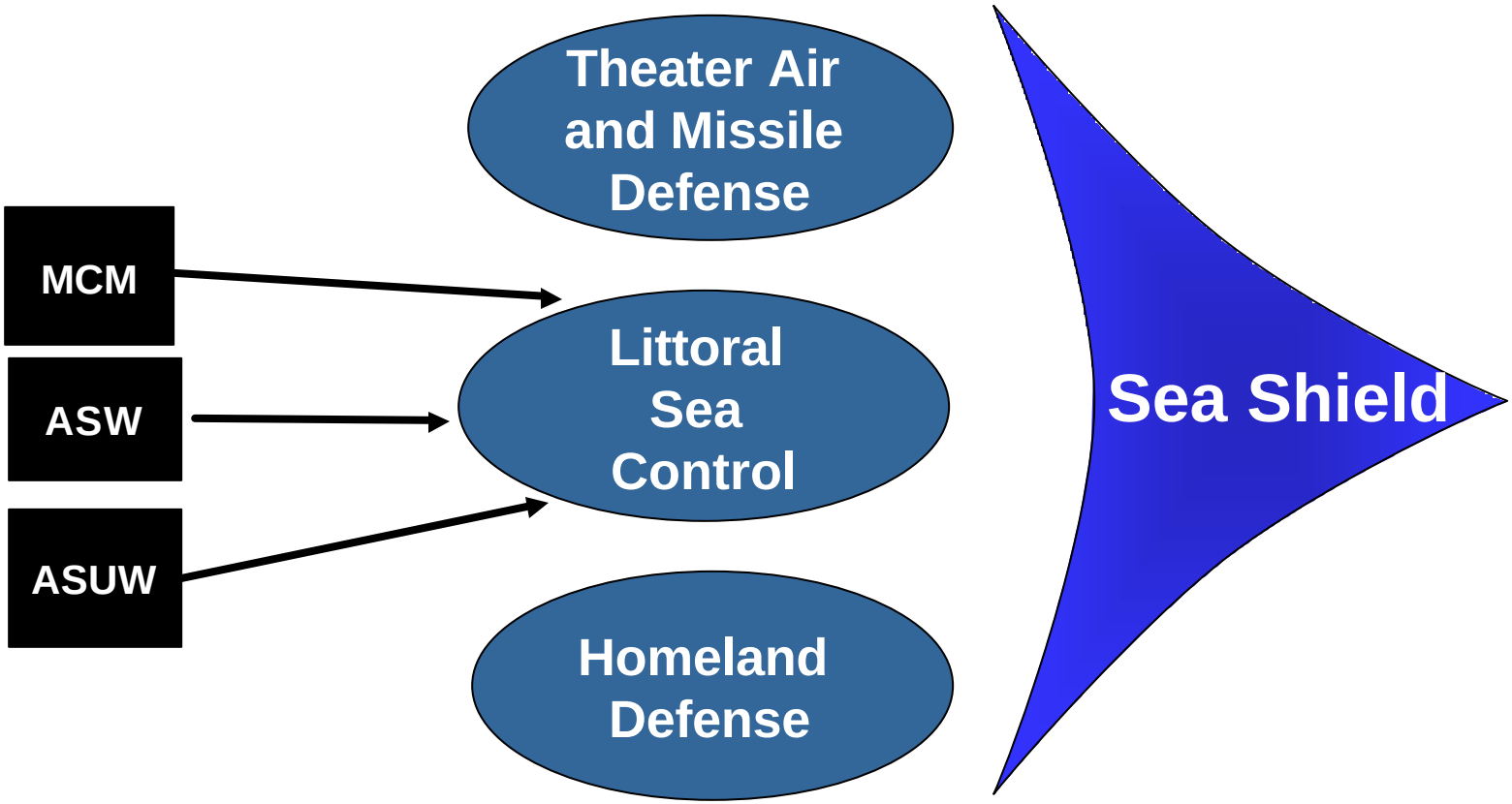
Fleet Needs

Architectural Baselines Mission Capability Architectures FoS Architecture Integration	System and functional analyses I & I risk assessments FoS Integration Documents RDA I&I Interest Programs	Anti Tamper Technology Transition	Mission Capability Integration Mission Area Coordination

Repository for Requirements Documents, Mission Capability Packages, C4ISPs, I&I tools, access to authoritative sources

Naval Collaborative Environment (NCEE)

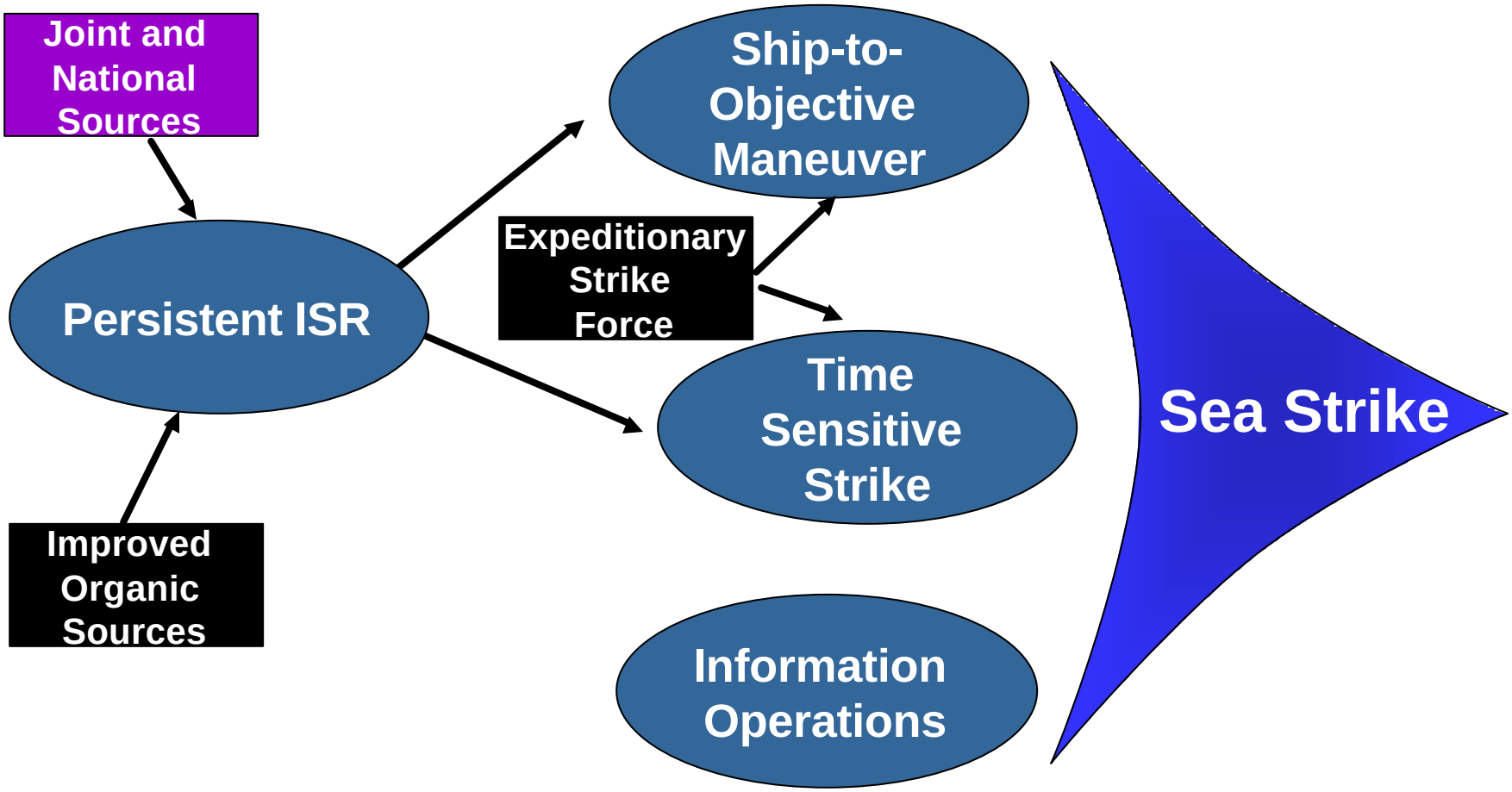
Sea Shield
Transformational Capabilities



Assure access throughout the battlespace to let the Joint Force "climb into the ring" on our timetable

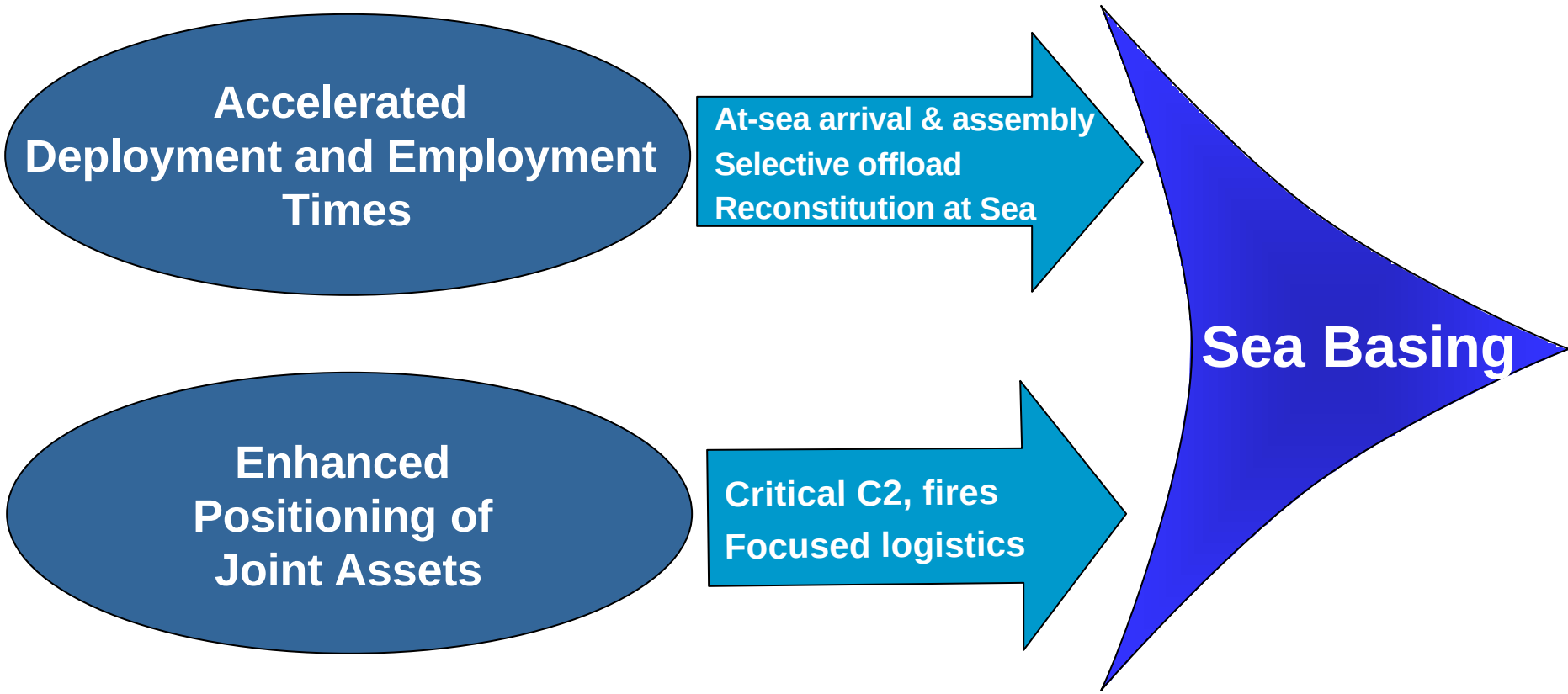
Project defensive sphere to assure our homeland and that of partners

Sea Strike Transformational Capabilities



Project decisive and persistent offensive power

Sea Basing
Transformational Capabilities



Provide worldwide basing options for fighting and winning
Operate immediately from an expanded, secure maneuver area
Minimize vulnerabilities tied to overseas land support

FORCEnet

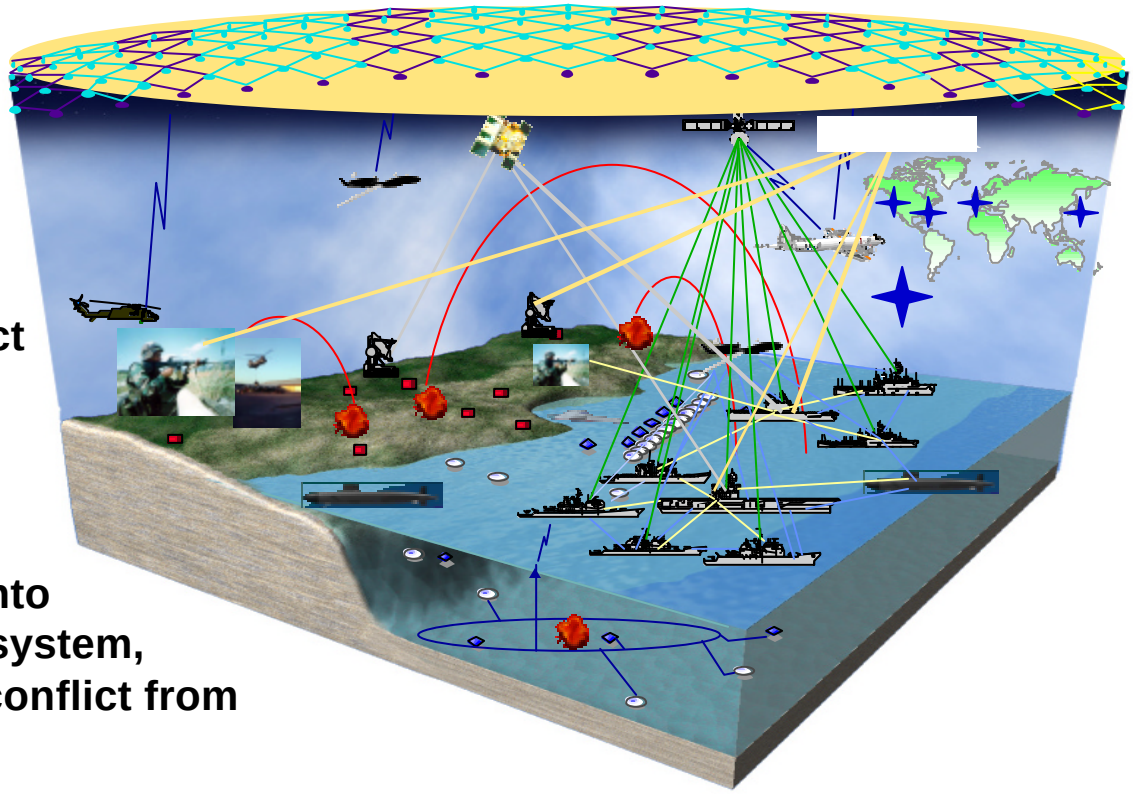
Network Centric Warfare is the theory.

Network Centric Operations is the concept.

FORCEnet is the process of making the theory and concept a reality.

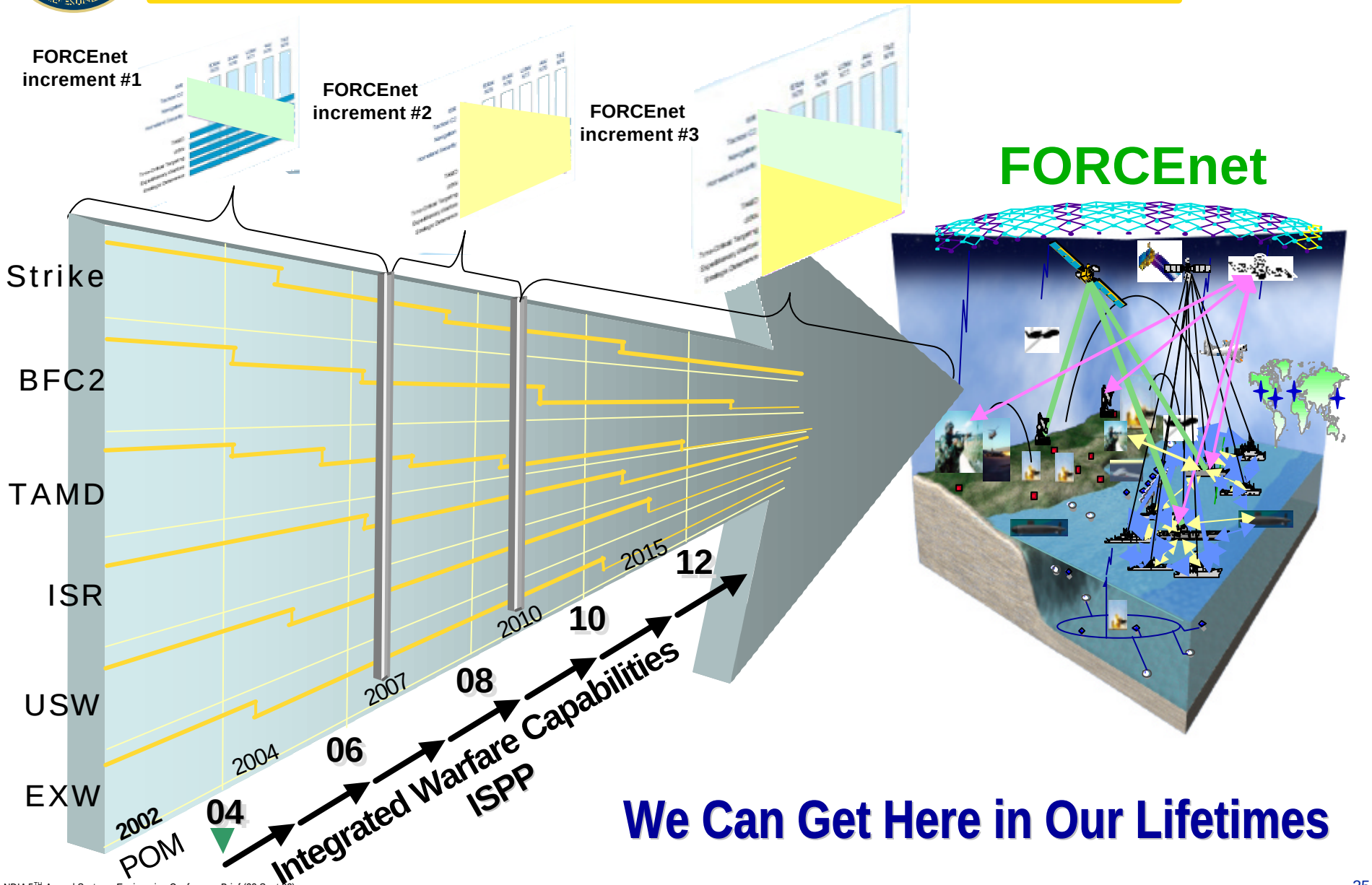
FORCEnet is the operational construct and architectural framework for Naval Warfare in the Information Age which integrates Warriors, sensors, networks, command and control, platforms and weapons into a networked, distributed combat system, scalable across the spectrum of conflict from seabed to space and sea to land.

Seamless Information Grid



FORCEnet IS THE SYSTEMATIC ACCELERATION OF NCW TO REALITY

Capability Evolution Will Enable Transformation



We Can Get Here in Our Lifetimes